

3-5

Reading to Learn Mathematics**Proving Lines Parallel****Pre-Activity** How do you know that the sides of a parking space are parallel?

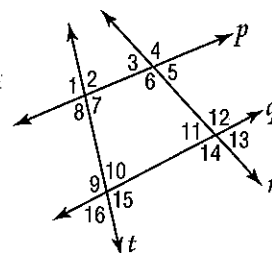
Read the introduction to Lesson 3-5 at the top of page 151 in your textbook.

How can the workers who are striping the parking spaces in a parking lot check to see if the sides of the spaces are parallel?

Reading the Lesson

1. Choose the word or phrase that best completes each sentence.
 - a. If two coplanar lines are cut by a transversal so that corresponding angles are congruent, then the lines are _____ (parallel/perpendicular/skew).
 - b. In a plane, if two lines are perpendicular to the same line, then they are _____ (perpendicular/parallel/skew).
 - c. For a line and a point not on the line, there exists _____ (at least one/exactly one/at most one) line through the point that is parallel to the given line.
 - d. If two coplanar lines are cut by a transversal so that consecutive interior angles are _____ (complementary/supplementary/congruent), then the lines are parallel.
 - e. If two coplanar lines are cut by a transversal so that alternate interior angles are congruent, then the lines are _____ (perpendicular/parallel/skew).
2. Which of the following conditions verify that $p \parallel q$?

A. $\angle 6 \cong \angle 12$	B. $\angle 2 \cong \angle 4$
C. $\angle 8 \cong \angle 16$	D. $\angle 11 \cong \angle 13$
E. $\angle 6$ and $\angle 7$ are supplementary.	F. $\angle 1 \cong \angle 15$
G. $\angle 7$ and $\angle 10$ are supplementary.	H. $\angle 4 \cong \angle 16$

**Helping You Remember**

3. A good way to remember something new is to draw a picture. How can a sketch help you to remember the Parallel Postulate?

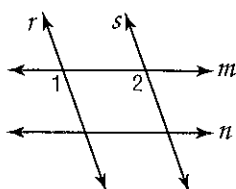
3-5 Study Guide and Intervention

Proving Lines Parallel

Identify Parallel Lines If two lines in a plane are cut by a transversal and certain conditions are met, then the lines must be parallel.

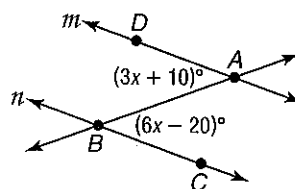
If	then
<ul style="list-style-type: none"> • corresponding angles are congruent, • alternate exterior angles are congruent, • consecutive interior angles are supplementary, • alternate interior angles are congruent, or • two lines are perpendicular to the same line, 	the lines are parallel.

Example 1 If $m\angle 1 = m\angle 2$, determine which lines, if any, are parallel.



Since $m\angle 1 = m\angle 2$, then $\angle 1 \cong \angle 2$. $\angle 1$ and $\angle 2$ are congruent corresponding angles, so $r \parallel s$.

Example 2 Find x and $m\angle ABC$ so that $m \parallel n$.



We can conclude that $m \parallel n$ if alternate interior angles are congruent.

$$m\angle BAD = m\angle ABC$$

$$3x + 10 = 6x - 20$$

$$10 = 3x - 20$$

$$30 = 3x$$

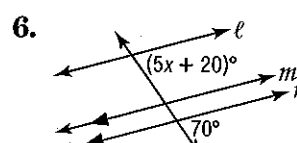
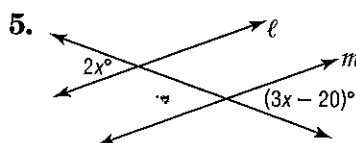
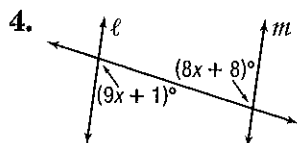
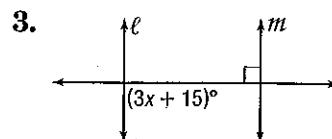
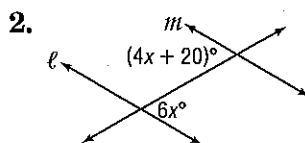
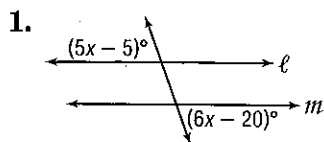
$$10 = x$$

$$m\angle ABC = 6x - 20$$

$$= 6(10) - 20 \text{ or } 40$$

Exercises

Find x so that $\ell \parallel m$.



3-5 Study Guide and Intervention (continued)

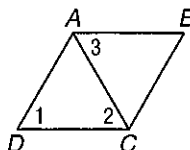
Proving Lines Parallel

Prove Lines Parallel You can prove that lines are parallel by using postulates and theorems about pairs of angles. You also can use slopes of lines to prove that two lines are parallel or perpendicular.

Example

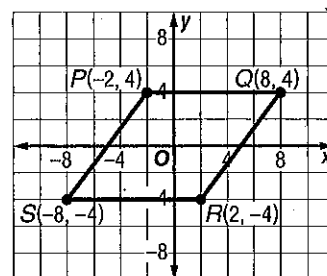
a. Given: $\angle 1 \cong \angle 2$, $\angle 1 \cong \angle 3$

Prove: $\overline{AB} \parallel \overline{DC}$



Statements	Reasons
1. $\angle 1 \cong \angle 2$ $\angle 1 \cong \angle 3$	1. Given
2. $\angle 2 \cong \angle 3$	2. Transitive Property of \cong
3. $\overline{AB} \parallel \overline{DC}$	3. If alt. int. angles are \cong , then the lines are \parallel .

b. Which lines are parallel?
Which lines are perpendicular?



slope of $\overline{PQ} = 0$ slope of $\overline{SR} = 0$
slope of $\overline{PS} = \frac{4}{3}$ slope of $\overline{QR} = \frac{4}{3}$
slope of $\overline{PR} = -2$ slope of $\overline{SQ} = \frac{1}{2}$
So $\overline{PQ} \parallel \overline{SR}$, $\overline{PS} \parallel \overline{QR}$, and $\overline{PR} \perp \overline{SQ}$.

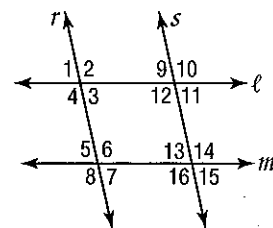
Exercises

For Exercises 1-6, fill in the blanks.

Given: $\angle 1 \cong \angle 5$, $\angle 15 \cong \angle 5$

Prove: $\ell \parallel m$, $r \parallel s$

Statements	Reasons
1. $\angle 15 \cong \angle 5$	1. _____
2. $\angle 13 \cong \angle 15$	2. _____
3. $\angle 5 \cong \angle 13$	3. _____
4. $r \parallel s$	4. _____
5. _____	5. Given
6. _____	6. If corr \angle s are \cong , then lines \parallel .



7. Determine whether $\overline{PQ} \perp \overline{TQ}$. Explain why or why not.

